The following investigations have been carried out in this thesis

1)Cordierite is already well known for its low thermal expansion behaviour. Chemical substitutions at various octahedral and tetrahedral sites have been done and their thermal expansion characteristics have been studied Synthesis of cordierite in more reactive environment provided by AlF_3 used as sintering aid has been attempted

2) Diffuse ferroelectric phase transition of lead based perovskite materials leads to low expansion region. Solid solutions of lead iron niobate with lead titanate is investigated to increase the structural distortion and see it this low expansion region can be extended to wider temperature Preparation of materials with higher tetragonal distortion In $PbTi0_3$- $BlFeO_3$ system is undertaken to study the thermal expansion anisotropy.

3) Composites between lead iron niobate(+(x) and lead titanate (-(x below T_c) has been undertaken to prepare low expansion hulk over a wide temperature range

4) Acoustic emission has been employed as a tool to detect the microcracking in solid solutions between PFN_{1-x}, PT_x, and PT_{1-x}, BF_x, It is hoped to understand relation between magnitude of lattice distortion transition temperature and microcracking in ceramics of the class of materials.